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### *Reply to the Editor:*

We appreciate Ricci's interest in our article,[1] which describes the application of a "modified" central cannulation technique[2] and open proximal anastomosis technique for surgical repair of aortic coarctation in an adult. We understand Ricci's concern that circulatory arrest to perform open proximal anastomosis is not free from complications. Our strategy of cannulation and cardiopulmonary bypass support for aortic coarctation in an adult is based on our previous experience that aortic injury was caused by crossclamping, in which the portion of coarctation was just distal to the left subclavian branch. As Ricci mentioned in his letter, our proposal of this strategy is based on a single observation; however, it seems safer to use an open proximal anastomosis technique to avoid possible aortic injury not only with crossclamping but also with reliable deep stitches in sufficient sight.

We recently used the same strategy in an operation for distal arch and descending aortic aneurysm. We experienced no technical or clinical problems; therefore, we agree with Ricci that this strategy can serve as a valuable adjunct in patients undergoing complex repairs and reoperations of the distal arch and descending aorta.[3-5]

*Akira Yamada, MD, PhD*
*Kiyofumi Morishita, MD, PhD*
*Nobuyoshi Kawaharada, MD, PhD*
*Jyoji Fukada, MD, PhD*
*Tomio Abe, MD, PhD*
*Department of Surgery (II)*
*Sapporo Medical University School of Medicine,*
*Sapporo, Hokkaido, Japan*

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## Mitral valve replacement by a Gore-Tex reinforced pulmonary autograft in a child

### *To the Editor:*

We read the interesting case report entitled "Mitral valve replacement by a Gore-Tex reinforced pulmonary autograft in a child" in the October issue of the *Journal*.[1] The Ross II procedure is not widely used in cardiac surgical practice because of the technical difficulties. There are also many arguments concerning this procedure.[2] There might be complications such as constriction and deformation on the mitral position of the pulmonary autograft. Therefore, lengthwise and crosswise reinforcements of the pulmonary autografts might be needed. The procedure is possible with the use of Dacron or polytetrafluoroethylene (Gore-Tex; W. L. Gore & Associates, Inc, Flagstaff, Ariz) grafts.

For pediatric patients with a small mitral annulus, the Ross II procedure is indicated. We performed the Ross II procedure in a child with congenital mitral insufficiency and endocarditis. The mitral leaflets were totally deformed, so we resected them. The mitral annulus was 14 mm in diameter. We decided to replace the mitral valve with a pulmonary autograft because of the endocarditis and the absence of an adequately sized mechanical mitral valve prosthesis. After the pulmonary autograft was harvested, it was introduced into the 14-mm diameter soft Dacron tube graft by the same method that the authors used. Because the left atrium was very large, a Dacron graft carrying the pulmonary autograft was sutured to the mitral annulus by using the "top hat" technique.[3] However, perioperative transesophageal echocardiography performed after cardiopulmonary bypass revealed a 25 mm Hg transmitral gradient. We decided to reinstitute cardiopulmonary bypass and reevaluate the composite pulmonary autograft. After cardioplegic arrest, the left atrium was reopened, and the Dacron graft was found to be constricted and deformed. Therefore the Dacron graft was replaced with a 14-mm diameter polytetrafluoroethylene (Gore-Tex) tube graft. This time there was no significant transmitral gradient.

We believe that stiff Dacron grafts used for the reinforcement of pulmonary autografts may yield better results than soft ones. We recommend the use of polytetrafluoroethylene (Gore-Tex) tube grafts in the Ross II procedure instead of the Dacron grafts that Yamagushi and colleagues[1] used.

*Emin Tireli, MD*[a]
*Gürkan Çetin, MD*[b]
*İlksen Söyler, MD*[a]
*Ahmet Özkara, MD*[b]
*Department of Cardiovascular Surgery*[a]
*Istanbul Medical School*
*Department of Cardiovascular Surgery*[b]
*Institute of Cardiology*
*Istanbul University*
*Uskudar-Istanbul, Turkey*

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### *Reply to the Editor:*

My colleagues and I appreciate the thoughtful comments of Dr Tireli. In children, the top hat method[1] is limited to selected patients with a large left atrium. The implanted graft, which over-protrudes into the left atrium, carries a risk of pulmonary venous obstruction and may impair the reservoir effect of the left atrium. The top hat method is relatively easy during the

Ross II operation, because the left ventricular end of the graft can be used as a margin for suturing to the mitral annulus. A sewing cuff around the graft is unnecessary. However, stronger lengthwise reinforcement is essential to maintain the shape of the autograft. It seems to me that the pulmonary autograft flattened out in Dr Tireli's patient, and that the consequent left ventricular inflow obstruction caused pulmonary congestion because the lengthwise reinforcement of the pulmonary autograft failed. A semi-flexible Dacron graft is probably an inappropriate choice of material for the external cylinder of the pulmonary autograft in pediatric patients. A semirigid graft designed to resist elongation both lengthwise and crosswise is more suitable for reinforcing the pulmonary autograft. At present, I believe that a nonstretch-type polytetrafluoroethylene graft (Gore-Tex; W. L. Gore & Associates, Inc, Flagstaff, Ariz) is the best material. Because the left ventricular end (the pulmonary commissure end) of the graft is anastomosed to the mitral annulus in the top hat method, varus deformity of the pulmonary commissures and subsequent narrowing of the orifice are prevented. If the left atrial end of the graft (the pulmonary annular end) is anastomosed to the mitral annulus, left ventricular outflow obstruction is infallible, because the implanted graft protrudes into the left ventricle. In addition, varus deformity of the pulmonary commissures because of the left ventricular inner pressure is infallible in the absence of a rigid commissural stent.

A great advantage of our technique,[2] in which a sewing cuff made of a polytetrafluoroethylene felt is anastomosed to the middle portion of the polytetrafluoroethylene (Gore-Tex) graft, is that neither end of the graft protrudes into the left atrium or the left ventricle. Furthermore, because of the sewing cuff, the polytetrafluoroethylene (Gore-Tex) graft is fairly close to the left ventricular end (the pulmonary commissure end) of the graft and is tightly anastomosed to the mitral annulus. Therefore, varus deformity of the pulmonary commissure is prevented in the absence of a rigid stent. The polytetrafluoroethylene (Gore-Tex) external cylinder ensures an adequate neo-mitral orifice.

In conclusion, although there are some technical difficulties, I believe that the Ross II operation is a useful surgical option for pediatric patients with a narrow mitral annulus. With our technique, the Ross II operation is suitable for infants with a narrow left atrium or atrioventricular septal defect and left ventricular outflow obstruction.

*Masaaki Yamagishi, MD, PhD*
*Department of Pediatric Cardiovascular Surgery*
*Children's Research Hospital*
*Kyoto Prefectural University of Medicine*
*Kyoto, Japan*

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## Intraoperative hematocrit and cardiopulmonary bypass

***To the Editor:***

I read with interest the article by Habib and associates[1] in the June issue of the *Journal* concerning the role of the lowest hematocrit as the predictor variable on early and late postoperative outcomes. It is important to maintain the hematocrit within the normal range and avoid extremes. The mere effect of such a strong association begs for a prospective randomized study, as stated by the authors. However, their discussion and conclusion based on the large number of retrospective patients are incomplete. In the field of cardiovascular epidemiology, anemia occurs in 15% to 55% of patients with chronic heart failure.[2] However, it is unknown whether a strong association of anemia and heart failure has any temporal and causal relation, that is, whether anemia precedes and leads to heart failure.

Nonetheless, the authors do not mention the characteristics and prevalence of heart failure in the baseline data. An argument for expanded plasma volume occurring in acute heart failure, seen in decompensated heart failure, might contribute to low hemoglobin concentrations. Such a feature is not uncommon in patients undergoing nonpercutaneous transluminal coronary angioplasty in our era.

It would seem intuitive to deduct that patients who undergo off-pump cardiac bypass surgery with minimal blood loss have less activation of the inflammatory cascade from the bypass circuit and do better. However, given the already available data from randomized trials, no difference exists between the 2.[3] This suggests a minimal role for the intraoperative spectrum of hematocrit in off-pump surgery. Another important question that was not answered was whether aprotinin was given consistently, because this drug can also modify patients' outcomes.[4]

Habib and colleagues[1] gave no information about the mean number of grafts per patient, perioperative blood loss, blood-saving techniques, and "transfusion trigger." These issues are important because there is a dose-dependent association between blood transfusion and the development of severe postoperative infection and death in patients undergoing cardiac surgery.[5]

Despite this omission, the overall in-hospital mortality rate is slightly higher than that reported for a similar series of 2,569 patients undergoing coronary artery bypass grafting in whom the "transfusion trigger" during cardiopulmonary bypass (CPB) was a packed-cell volume of less than 20% and mortality was defined as death during the hospital stay or within 30 days of surgery (3.6% vs 2.79%).[5]

Was the pump primed with blood? Administration of blood during CPB may begin a cascade of events that contributes to postoperative. Thus, whenever possible, preoperative pharmacologic therapy, but not transfusional, treatment of anemia should be used.

Also, the authors probe the data to determine any association of anemia and late mortality. It is interesting that the authors do not report the reason for patient death. Because the case mix of death is important, if cardiovascular death was the cause, did any of the patients who received more blood or had the lowest hematocrit have a lower graft patency in the short and long term?

Finally, according to the range of absolute differences in the perioperative hematocrit shown in Table 1 of the article (difference between preoperative and postoperative CPB hematocrits; range 12%-15.2%), it would seem more reasonable to use this parameter than individual values if